# QUALITY ASSURANCE PROJECT PLAN

## FOR A

## SITE CHARACTERIZATION AT THE HERCULANEUM LEAD SMELTER

DRAFT

## HERCULANEUM, MISSOURI
## CERCLIS ID NO.: MOD006266373

**Prepared For:**

**U.S. Environmental Protection Agency Region VII**
**Superfund Division**
**901 North 5th Street**
**Kansas City, Kansas 66101**

**Prepared By:**

**The Doe Run Company**

**January 21, 2002**

**APPROVED BY:**

**The Doe Run Company Project Manager, Jim Lanzafame** _____ **Date**

**EPA Project Manager, Anthony Petruska** _____ **Date**

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# 1.0 PROJECT MANAGEMENT

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## 1.1 DISTRIBUTION LIST

| | |
|---|---|
| **Region VII EPA** | **Anthony Petruska, USEPA Project Manager**<br>**Jim Silver, USEPA Onsite Coordinator** |
| **The Doe Run Company** | **Jim Lanzafame, Project Manager**<br>**Gary Walker, Onsite Coordinator** |

## 1.2 PROJECT/TASK ORGANIZATION/SCOPE OF WORK

**Jim Lanzafame, of The Doe Run Company, will serve as the Project Manager for the activities described in this Quality Assurance Project Plan (QAPP) to be conducted at the Herculaneum Lead Smelter Site in Herculaneum, Missouri. He will be responsible for overall coordination of site activities, ensuring implementation of the QAPP, and providing periodic updates concerning the status of the project, as needed. Gary Walker will be The Doe Run Company Project Coordinator for this activity.**

**One to two people will comprise the field/sampling team. The team will be responsible for assisting Doe Run with surveying activities, obtaining access to properties, acquisition and calibration of sampling equipment, sample collection, field screening, documentation of residential property conditions and field activities, and coordination of laboratory analyses. The laboratory Quality Assurance (QA) Manager will provide technical assistance, as needed, to ensure that necessary QA issues are adequately addressed.**

**This QAPP was prepared to address properties which are being remediated or have been remediated. The scope of work includes obtaining property access, surveying/marking sampling cells at each property, collection of sub-surface soil samples for field screening and laboratory analyses, collection of wipe samples within the houses where the yard soil has been replaced, and lead source sampling within these houses. Some Doe Run owned houses will also be sampled after quarterly interior cleanups.**

**Although an attempt will be made to adhere to this QAPP as much as possible, the proposed**

activities may be altered in the field if warranted by site-specific conditions and/or unforeseen hindrances that prevent any aspect of this QAPP from being implemented in a feasible manner. Such deviations will be recorded in the site logbook as necessary. This QAPP will be available to the field team(s) at all times during sampling activities to serve as a key reference for the proposed activities described herein.



## 1.3 PROBLEM DEFINITION/BACKGROUND/SITE DESCRIPTION

This QAPP was prepared by The Doe Run Company to address imminent and long-term concerns that could impact human health and/or the environment at the HLS site (site), where metals-contaminated soils (predominantly lead) have been identified during previous sampling activities.

The HLS site is located at 881 Main Street in Herculaneum, Missouri, about 25 miles south of the St. Louis metropolitan area (see Attachment A - Figure 1: Site Location Map). The site property is approximately 52 acres in size. An approximately 24-acre slag storage pile is located south of the smelter in a horseshoe bend of Joachim Creek. The slag pile is located in the floodplain of Joachim Creek, in an area classified as a wetland. The smelter site is bordered on the east by the Mississippi River and on the north and west by residential areas. South of the smelter is the slag pile and wetland area. The slag pile is bordered to the east, west, and south by Joachim Creek, and to the north by residential areas and the smelter facility (see Attachment B - Figure 2: Aerial Photography). The slag pile and most of the smelter facility are located in Jefferson County, Section 29, T. 41 N., R.6 E., although the northern portion of the facility extends into Section 20. Geographic coordinates of the site are 38° 15' 19.0" north latitude and 90° 22' 56.7" west longitude.

The site is an active lead smelter, the largest of its kind in the United States. HLS began operations in 1892 as part of the St. Joseph Lead Company. In 1986, it became part of the newly formed Doe Run Company (Doe Run), a joint venture of the Fluor Corporation and the Homestake Mining Company. In 1990, the Fluor Corporation became the sole owner of Doe Run. The site consists of three main areas: (1) the smelter plant, located on the east side of Main Street; (2) the slag storage pile; and (3) office buildings on the west side of Main Street.

The following major processes occur at the HLS site: (1) sintering, smelting, and refining of lead ore; (2) sulfuric acid production from waste sulfur-containing gases generated by the sintering

operation; and (3) wastewater treatment. The smelting operation generates a molten slag, 20 percent of which is sent to a slag storage pile. The slag pile occupies approximately 24 acres in the floodplain of Joachim Creek, and is up to 40 feet tall in some sections. In 1993, during a major flood event, water reached several feet up the sides of the slag pile. The site also generates stack air emissions from the smelter and fugitive air emissions from various operations (MDNR, 1999).

Several investigations have been conducted at the site, including a Preliminary Assessment/ Screening Site Inspection by the EPA in 1980, a multimedia compliance inspection by the EPA in 1995, a Preliminary Ecological Risk Assessment for Fish and Wildlife Habitats by the U.S. Fish and Wildlife Service (USFWS) in 1998, and a Preliminary Assessment by the Missouri Department of Natural Resources (MDNR) in 1998 and 1999. In addition to these state and federal lead investigations, the facility has collected and submitted to the state a large quantity of environmental data pursuant to Missouri's site-specific State Implementation Plan (SIP) established under the Clean Air Act (CAA), National Pollutant Discharge Elimination System (NPDES) permit, Metallic Minerals Waste Management Act permit, and voluntary soil cleanup efforts in the surrounding Herculaneum community.

Based on previous investigations, primary metal contaminants in the slag pile include arsenic, cadmium, copper, lead, nickel, and zinc. The slag pile has been partially inundated by flood water in the past. The USFWS identified significant concentrations of lead, cadmium, and zinc in floodplain soils; significant concentrations of lead and zinc in river sediments; and significant zinc concentrations in surface water samples collected from drainage ditches on the Joachim Creek floodplain.

Stack and fugitive emissions from the site, and fall-out from these emissions, have resulted in releases of lead, cadmium, and sulfur dioxide to the air and soil. Since 1980, the smelter's emissions have been regulated under general and site-specific regulation established in the SIP. Lead emissions at one air monitoring station near the site have consistently been above the 1.5 microgram per cubic meter ($\mu g/m^3$) National Ambient Air Quality Standard (NAAQS), since it was installed in 1992. Due to the continued noncompliance with the NAAQS standard, new SIP regulations were developed by the site and MDNR.

Soil sampling has shown lead levels ranging from 100 to higher than 12,800 parts per million (ppm) in the surface soils of homes surrounding the smelter. A 2000 Jefferson County Health Department study identified 1 house hold having two children with blood leads greater than 15 micrograms per deciliter (ug/dl). This home had soil levels below 400 ppm. Thirteen out of 21 birds tested as part of the USFWS study showed clinical or subclinical lead poisoning based on liver analysis. Fish and tissue samples collected during this study had lead concentrations up to 7.5 ppm. Under a groundwater monitoring program conducted at the site since 1980, lead and cadmium concentrations in the groundwater, not in the drinking water aquifer, has periodically been found above the respective maximum contaminant levels (MCLs) established under the Safe Drinking Water Act. The MCLs for lead and cadmium are 15 parts per billion (ppb) and 5 ppb, respectively for drinking water.

In August of 2001, EPA was notified by a Herculaneum citizen of a grey powdery substance on the roads in the town. Further investigation identified the substance containing lead at 300,000 ppm or 30%. Additional field screening identified the trucks delivering lead concentrate to the Doe Run Smelter as the likely source of the material along the haul routes in the town.

## 1.4 PROJECT/TASK DESCRIPTION

The activities described in this QAPP will address the following:

A. Surface soil contamination in residential yards, day-care facilities, areas in schoolyards frequented by children, parks, and all other child high-use areas affected by the HLS operations located east of and adjacent to U. S. Highway 61 and north of Joachim Creek in the township of Herculaneum, which have not yet been determined.

B. Subsurface soil in residential yards, day-care facilities, areas in schoolyards frequented by children, parks, and all other child high-use areas affected by the HLS operations located east of and adjacent to U. S. Highway 61 and north of Joachim Creek in the township of Herculaneum, after contaminated soil is removed and before new soil is put in place.

C. Clearance sampling using wipe samples within homes after cleaning.

D. Interior sources sampling for lead within the home.



## 1.5 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The QA objective for this project is to provide valid data of known and documented quality. Specific Data Quality Objectives (DQO's) are discussed in terms of accuracy, precision, completeness, representativeness, and comparability.

For this project, accuracy is defined as the ratio, expressed as a percentage, of a measured value to a true or reference value. The measurement process of a contaminant concentration includes separate field and laboratory measurements. Errors are associated with each of these two types of measurements. These errors will be quantified and expressed as a measure of accuracy. The analytical component of accuracy will be expressed as Percent Recovery based on the analysis of lab-prepared spike samples and Performance Evaluation (PE) audit samples.

Precision for this project is defined as a measure of agreement among individual measurements of the same property and will be expressed via duplicate samples. The overall precision is assessed by collection of duplicate or collocated samples. Approximately 10% of duplicate/collocated samples is anticipated.

Data completeness will be expressed as the percentage of data generated that is considered valid. A completeness goal of 100% will be applied to this project; however, if that goal is not met, site decisions may still be made based on the remaining data. No specific critical samples have been identified for the project.

Representativeness of collected samples is facilitated by establishing and following criteria and procedures identified in this QAPP.

Data comparability is achieved by requiring all data generated for the project be reported in common units. The following table lists the various types of data that will be generated and the specific reporting units.

| SPECIFIC DATA REPORTING UNITS | |
|---|---|
| **PARAMETER** | **UNIT** |
| Metals in Soil by X-ray Fluorescence Spectrometer (XRF)<br>Lead in wipe samples by XRF<br>Lead in painted surfaces | PPM |
| Metals in Soil by Laboratory Analysis<br>Lead in wipe samples by Laboratory Analysis | milligrams per kilogram (mg/kg) |
| Metals in Air | micrograms per cubic meter ($\mu g/m^3$) |
| Sampled Air Volume at Standard Temperature and Pressure (STP) | cubic liters at STP ($m^3$ STP) |
| Sampling Flowrate at STP | cubic liters per minute at STP ($m^3/min$ STP) |
| Wind Speed | miles per hour (mph) |
| Wind Direction (Field Report) | degrees on an azimuth compass |
| Temperature | degrees Farenheit (°F) |
| Barometric Pressure (not corrected to sea level) | Millimeters of mercury (mm Hg) |
| Time | military time (00:00 - 24:00) |
| Date | month/day/year |

## 1.6 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

**All site personnel, depending on the type of work being done, will be required to have completed basic OSHA Lead Training, modified Lead Abatement Training, or 40-hour health and safety (Hazardous Waste Operations and Emergency Response [HAZWOPER]) training course and annual refreshers. Familiarization with the Niton™ XRF and its operating procedures will also be necessary for the site operators.**

## 1.7 DOCUMENTATION AND RECORDS

Doe Run/Contractor personnel will maintain records of pertinent activities associated with the sampling events. Appropriate documentation pertaining to activities will also be recorded in the field logbook. Information pertaining to all samples (i.e., sampling dates/times, locations, etc.) collected during this event will be recorded on sample field sheets generated by Doe Run. Labels generated by the sampler will be affixed to sample containers, identifying sample numbers, dates collected, and requested analyses. Chain of custody records will be completed/maintained for all samples from the time of their collection until they are submitted to the laboratory for analysis.

A health and safety plan will be prepared by Doe Run prior to the field activities that will address site-specific hazards. The health and safety plan will be reviewed and signed by all field personnel prior to field work, indicating that they understand the plan and its requirements. Copies of the plan will be available to all personnel throughout the sampling activities.

# 2.0 MEASUREMENT/DATA ACQUISITION

## 2.1 SAMPLING PROCESS DESIGN

The proposed sampling scheme for this project will be in accordance with the Removal Program Representative Sampling Guidance, Volume 1: Soil, OSWER Directive 9360.4-10, November 1991, Interior wipe sampling, EPA747-R-95-001, March 1995, Residential Sampling for Lead: Protocols for Dust and Soil Sampling, and judgmental (based on the best professional judgement of the sampling team). The sampling design proposed in the following paragraphs has been selected to identify the extent of soil contamination at the site, subsurface lead levels after excavation, interior lead source sampling and clearance sampling within the house. The proposed number of samples is a balance between cost and coverage and represents a reasonable attempt to meet the study objectives while staying within the budget constraints of a typical site investigation.

The characterization sampling will be conducted as soil replacement is concluded.

At a minimum, residential properties will have four quadrants established around the home, which will radiate out 50 feet from each side of the home. In each quadrant, a nine-aliquot composite

sample will be collected from the upper 1 inch of soil in the surface or the excavated subsurface and screened with a Niton™ XRF. Therefore, a minimum of 4 four samples will be collected from each resedential property. Surface soil samples will not be collected from within 3 feet of the residential dwellings to reduce the potential lead-based paint contribution to soil-lead concentrations. In addition, multi-aliquot surface soil samples will be taken at the drip line of each structure where a child under 6 years old with elevated blood lead is known to reside. Multi-aliquot surface soil samples will also be collected from any play areas, gardens, sand piles, unpaved driveways, and other areas appearing to be frequented by children. The number of aliquots for these areas will be dependent upon size, but, in general, will follow the aliquot density used for the quadrants. For subsurface sampling four quadrants will be generally sampled, each will be composed of 9 aliquots of subsoil.

A 9-aliquot soil sample will be collected from the five-foot section of residential yards and high child use areas adjacent to roads used as haul routes by the Doe Run Company and within the first 50 yards of the streets intersecting with those haul routes.

In addition to soil sampling at residential properties, indoor dust wipe samples will be collected at residential homes where soil replacement has already occurred and where interior cleanup has occurred, and the homes meet the one of the following criteria: 1) homes which have soil replaced in 2002 and a child less than 6 years of age; and 2) homes which have had soil replaced in late 2001 and have a child less than 6 years of age: and 3) Doe Run owned homes.

After the clearance samples have been ran a lead source survey will be ran on painted surfaces within the house. A Niton XRF will be used to make this survey of painted surfaces. The paint will also be evaluated as to conditions, good, fair or poor condition.

For locations where there are no residences, a center point, depicting a possible future building site, will be established and flagged. From the center point, four quadrants will be established, which will radiate out 100 feet in each compass direction, and the aforementioned sampling protocols will be completed (e.g. collecting a nine-aliquot composite from each quadrant).

Workers doing soil removal and cleaning interior cleaning will be monitored for lead in air per

OSHA requirements, 29CFR1910.1025.

A summary of anticipated samples to be collected for this project is provided in the following table. The exact number will depend on field screening results, as previously described. Approximately 10 percent of all screening samples will be collected for laboratory confirmation analysis whether related to soil, subsurface soil or interior dust. The source sampling will be conducted using only XRF readings.

| Matrix | Number of Samples | | Laboratory Analyses[1] |
|---|---|---|---|
| | Field Screening (Lead) | Laboratory | |
| Surface Soil | 40 | 4 | Lead, cadmium, arsenic, zinc, nickel |
| Dust | 320 | 32 | Lead |
| Air | NA | 4 | Lead |
| Subsurface Soil | 400 | 40 | Lead, cadmium, arsenic, zinc, nickel |

NA = Not Applicable
[1] See Section 2.4 for details pertaining to analyses.

## 2.2 SAMPLING METHODS REQUIREMENTS

Soil samples will be collected following the EPA Region 7 SOP #2231.12A: ERT #2012; "Soil Sampling". Confirmation soil samples will be collected with a clean, dedicated stainless steel spoon and homogenized in a clean, dedicated aluminum pie pan or shot directly in the sample bag. The samples will be screened with the XRF after homogenizing the soil, and three consecutive XRF readings will be collected, each at 20 nomsec. The three homogenized XRF readings will be recorded on a field sheet. The average of these results will be considered the result. Screening samples using the XRF will follow EPA Region 7 SOP # 4231.707A. The location of the XRF readings (as well as confirmation sample location, if necessary) will also be recorded on each field sheet. Confirmation samples will be transferred directly into the appropriate container for analysis. The samples will be submitted to a subcontracted laboratory.

Indoor dust sampling will be conducted in accordance with EPA 747-R-95-001, March 1995: Residential Sampling for Lead: Protocols for Dust and Soil Sampling with judgement of the sampler. A wipe sample media will be used for each sample. The dust sample will be collected from a one square foot area on floor surfaces and for window areas the area will be measured and the

result multiplied by the appropriate factor to equal one square foot. The sampling area will include high traffic areas, children bedrooms, and one window well interior to the window. Pertinent sampling information will be documented on field sheets. The dust wipe sample will be transferred directly into a dedicated container for XRF analysis or later laboratory analysis. Failure to achieve the clearance criteria by XRF analysis will require additional cleanup with a new clearance sample being collected.

All ambient air sampling will be accomplished using Personnel samplers, MSA, flowing at the rate of 2.0lpm for the cleaning period or until 7 hours has been achieved. In all cases, the policies described in this QAPP shall take precedence over other EPA SOPs. Each sampler will be positioned in the workers breathing zone per OSHA requirement and will be shut off when the worker leaves the work site.

Paint readings from the XRF will be recorded in a manner which will allow future identification of where lead can be found within each room if it is present. A rating of the paint condition will be made by the operator.

Disposal of investigation-derived wastes (IDW), house cleanup waste and procedures for equipment/personal decontamination will be addressed in a site-specific health and safety plan prepared by the Doe Run. In general, it is anticipated that most IDW will consist of disposable sampling supplies (gloves, paper towels, etc.) that will be disposed of off-site as uncontaminated debris. Vacuum materials will be taken to the plant where they will be disposed of in a container setup for this purpose.

## 2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Samples will be collected in accordance with procedures defined in Region VII EPA SOP 2130.4B. Chain of custody procedures will be maintained as directed by Region VII EPA SOP 2130.2A. Samples will be accepted by the contracted laboratory according to their specific procedures and SOPs.

All soil sample containers will be placed in plastic bags to control spillage in case the containers break during shipment. Soil and dust samples will be placed in suitable containers for shipment.

Necessary paperwork for all samples, including chain of custody records, will be completed by the sampling team and maintained with the shipping containers until delivery to the laboratory. If shipment of the samples is required via commercial service, each container lid will be securely taped shut, and two custody seals will be signed/dated and placed across the lid opening. The samples will be submitted to the receiving laboratory in a time-efficient manner to ensure that the applicable holding times are not exceeded.

## 2.4 ANALYTICAL METHODS REQUIREMENTS

The samples will be analyzed at a pre-qualified laboratory contracted by The Doe Run Company, according to the EPA methods listed in the following table. Detection limits that are typically reported by those methods are expected to be adequate for this activity. The requested analyses have been selected based on past sampling data and historical information collected for the site:

| ANALYTICAL METHODS | |
|---|---|
| Analytical Parameter [1] | EPA Method Number |
| SOIL/DUST | |
| Lead, cadmium, arsenic, zinc, nickel | SW846 Method 6010B |
| AIR | |
| Lead | SW846 Method 6010 B and 7000 Series |

Dust samples will be analyzed for lead only
[1] EPA may cease the analysis for zinc and nickel content if zinc and nickel concentrations in the initial confirmation samples are consistently below MDNR's Any Use Soil Levels.

## 2.5 QUALITY CONTROL REQUIREMENTS

Because dedicated supplies will be used for all samples (i.e., stainless steel spoons, pie pans, etc.), no QC samples will be required to assess the potential for cross-contamination. Analytical error (precision and accuracy) will be determined by the analysis of laboratory-prepared duplicates and spike samples. These criteria, along with other laboratory QC elements, will be performed in accordance with the contract laboratory's quality assurance plan.

To satisfy the quality control elements for the XRF, data will be collected and analyzed for comparability to laboratory data, to determine detection and quantitation limits, and to determine

accuracy and precision. Daily NIST samples supplied with the XRF will be ran. The mean of the three XRF readings taken for each confirmation sample will be compared statistically to the laboratory results for each confirmation sample to assess comparability. The measure of agreement ($r^2$) for the XRF unit should be above 0.7 or greater for the XRF data to be considered screening level data.

For every measurement, the Niton™ gives an uncertainty range that represents a 95 percent confidence interval. In general, precision/accuracy increases with increasing sample run time. Due to preliminary sample results indicating high lead levels, XRF sample run time will be increased accordingly to improve precision and accuracy. The goal is for samples to be screened long enough to obtain precision measurements within 20% of the actual concentrations. In the case of wipe samples the Niton will be ran for a minimum of 60 nomsec in order to get this greater accuracy.

## 2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Testing, inspection, and maintenance of all sampling equipment and supplies, along with field screening instrumentation, will be performed by Doe Run/ Doe Run Contracted personnel prior to deployment for field activities. Testing, inspection, and maintenance of analytical instrumentation will be performed in accordance with the contracted laboratory's analytical SOPs and manufacturers' recommendations.

## 2.7 INSTRUMENT CALIBRATION AND FREQUENCY

Calibration of the field screening and laboratory analytical instrumentation will be in accordance with the referenced SOPs and manufacturers' recommendations.

## 2.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

All sample containers will meet EPA criteria for cleaning procedures required for low-level chemical analysis. Sample containers will have Level II certifications provided by the manufacturer in accordance with pre-cleaning criteria established by EPA in *Specifications and Guidelines for Obtaining Contaminant-Free Sample Containers.* The certificates of cleanliness will be maintained in

the project file.

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## 2.9 DATA ACQUISITION REQUIREMENTS

Previous data/information pertaining to the site (including other analytical data, reports, photos, maps, etc., which are referenced in this QAPP) have been compiled by Doe Run from various sources including EPA's START Team. Some of that data has not been verified; however, that information will not be used for decision-making purposes without verification of its authenticity.

## 2.10 DATA MANAGEMENT

All laboratory data will be managed as specified in the contract laboratory's QAM. Preliminary data will be received by the project coordinator on site. The final data package will be forwarded to a chemist trained in data validation to complete the validation process. The results will be summarized and included in the report submitted to EPA.

# 3.0 ASSESSMENT/OVERSIGHT

## 3.1 ASSESSMENTS AND RESPONSE ACTIONS

Assessment and response actions pertaining to analytical phases of the project are addressed in the contracted laboratory's quality assurance manual(s). Because of the short duration of this sampling event, no field audits of sampling procedures will be performed. Corrective actions will be taken at the discretion of the EPA Project Manager, whenever there appears to be problems that could adversely affect data quality and/or resulting decisions affecting future response actions pertaining to the site.

## 3.2 REPORTS TO MANAGEMENT

A letter report describing the sampling techniques, locations, problems encountered (with resolutions to those problems), and interpretation of analytical results will be prepared by Doe Run, following completion of the field activities described herein and validation of laboratory data. The laboratory data for soil samples will be compared to all applicable or relevant and appropriate requirements (ARARs), including removal action levels that have been established for the site, to determine whether further response is warranted.

# 4.0 DATA VALIDATION AND USABILITY

## 4.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Data review and verification will be performed by a qualified laboratory analyst and the laboratory's section manager in accordance with the contracted lab's quality assurance program. The Doe Run Project Manager will be responsible for overall validation and final approval of the data, in accordance with the projected use of the results.

## 4.2 VALIDATION AND VERIFICATION METHODS

A qualified Doe Run chemist will review the data for laboratory spikes/duplicates and laboratory blanks to ensure that they are acceptable. The Doe Run Project Manager will inspect the data to provide a final review. The Doe Run Project Manager will also compare the sample descriptions with the field sheets for consistency and will ensure that any anomalies in the data are appropriately documented.

## 4.3 RECONCILIATION WITH USER REQUIREMENTS

If data quality indicators do not meet the project's requirements as outlined in this QAPP, the data may be discarded, and re-sampling and/or re-analysis may be required.

**ATTACHMENT A**

**Figure 1: Site Location Map**

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**ATTACHMENT B**

**Figure 2: Aerial Photography**

**(One page)**

**ATTACHMENT C**

**Figure 3: Sampling Map**

**(One page)**